NUCLEAR TEST READINESS

Do Subcritical Experiments Help?

Although the United States halted full-scale nuclear weapons tests almost 25 years ago, the nation does conduct small-scale subcritical nuclear experiments using plutonium and high explosives.

These subcrits, as they're called, are underground experiments at NNSS that are typically conducted safely inside steel confinement vessels. Subcrits are intended to help scientists study—without a full-scale nuclear weapon test—what, for example, are the negative effects aging plutonium pits have on the performance (yield) of weapons in the U.S. nuclear stockpile. (Rocky Flats, where plutonium pits were manufactured, closed in 1989.)

In a typical subcritical experiment, a small shell of plutonium is imploded using high explosives, increasing the plutonium's density until...there isn't a nuclear explosion. And that's the point. Unlike a full-scale nuclear weapons test, a successful subcrit ends without a nuclear bang—not even a whimper. The pit assembly doesn't have enough plutonium or high explosives to reach a critical mass.

A critical mass is the minimum amount of nuclear material (typically plutonium or uranium) needed to initiate the self-sustaining chain reaction that releases huge amounts of nuclear energy—aka a nuclear explosion. In a subcrit, the mass of plutonium used to make the pit remains subcritical. A self-sustaining nuclear chain reaction isn't possible; there is no nuclear yield, no nuclear explosion. The experiment is in line with the nuclear testing moratorium while allowing scientists to study, for example, how aging plutonium pits perform right up to just before going critically nuclear.

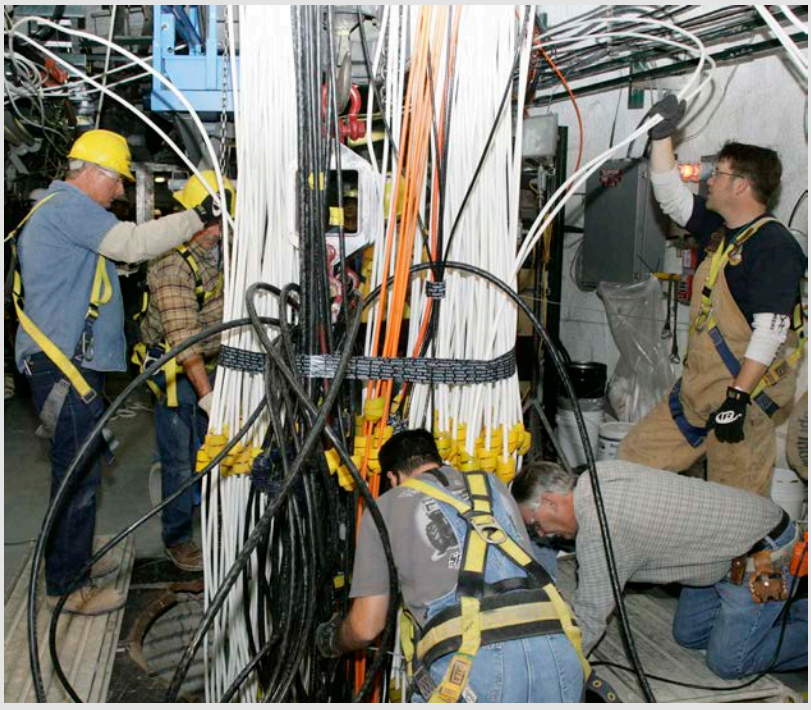
So, do subcritical experiments help maintain U.S. test readiness?

Yes, in the sense that all subcrits are relevant to maintaining test readiness because they exercise *some* of the aspects and skill sets used in full-scale testing, such as firing shots, employing specialized diagnostic equipment, and gathering data.

However, subcrits are small scale. A full-scale nuclear test, which reveals how well the entire device works from start to finish, is quantitatively and qualitatively different in many key ways. For example, safely containing a full-scale test requires the skills and equipment for carefully studying and geologically characterizing a test site, drilling an appropriately deep shaft, emplacing the test device and all of its diagnostic-related equipment deep underground, and then properly containing (stemming) the shaft so the massive detonation doesn't breach the surface.

These—and other critical skills—are not currently exercised by doing subcritical experiments.

In short, though valuable, subcrits don't address all of the issues required to maintain test readiness within a 24- to 36-month timeframe.



The Nevada National Security Site is the only place where subcritical experiments using plutonium and high explosives can be conducted. The U1a laboratory at the site, constructed nearly 1,000 feet underground, is where these experiments are typically conducted. Here, workers prepare to conduct an experiment in the U1a laboratory. (Photo: Los Alamos)